



ATTO Technology, Inc.

Installation and Operation Manual

ATTO ExpressPCI Ultra/WIDE SCSI Host Adapters

Express PCI PSC: Single-Channel Single-Ended Ultra/WIDE
ExpressPCI DC: Dual-Channel Single-Ended Ultra/WIDE

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Contents

1 What is ATTO ExpressPCI?	1
Features	
Operating Environments	
Power Requirements	
Environmental and Physical Specifications	
SCSI Connectors	
2 SCSI is a key technology for storage	3
Glossary	
3 Installing the ExpressPCI SCSI Host Adapter	5
System requirements	
Installation	
3.1 Determining cabling and termination	7
Cable types	
Examples	
Connectors	
Connection considerations	
Termination	
3.2 Installing and Updating Device Drivers	11
Windows Server 2003 & Windows 2000/XP	
Windows NT Installation	
Re-flashing Firmware in Windows	
Linux and Sun Solaris Driver Installation	
Updating Drivers and Re-flashing Firmware in Mac OS X	
Updating Drivers and Re-flashing Firmware in Mac OS 9	
4 Maximizing Performance with your ExpressPCI HBA	15
Use the latest ATTO driver	
Set registry for large block transfers	
Set up RAID groups with ATTO ExpressRAID	
Increase transfer size	
Analyze your I/Os	
5 Troubleshooting	17
Appendix A Standards and compliances	i
Appendix B SCSI host adapter selection guide	ii
Appendix C Fibre Channel host adapter guide	iii
Appendix D Contact ATTO Technology, Inc.	iv

1 What is ATTO ExpressPCI?

Compatible with virtually all popular SCSI devices, ATTO ExpressPCI host adapters will increase the performance of disk-intensive applications such as digital video, prepress, multimedia and real-time.

The ATTO ExpressPCI family of Ultra/WIDE SCSI host adapters includes:

ExpressPCI PSC

Single-Channel, Single-Ended Ultra/WIDE

ExpressPCI DC

Dual-Channel, Single-Ended Ultra/WIDE

Plug and Play for PCI-based computers The ATTO ExpressPCI SCSI adapter uses plug and play technology to eliminate configuration manipulation, including setting termination for single-ended adapters. Insert the ATTO ExpressPCI SCSI adapter into your PCI-based computer and the adapter is configured according to your system.

ATTO offers a variety of tools if you need to alter the host adapter's configuration. Refer to the ExpressPCI Utilities manual for additional information on these tools.

Features

- ❖ Automatic termination
- ❖ Advanced Data Streaming (ADS™) Technology
- ❖ RAID ready
- ❖ Embedded RISC I/O processor
- ❖ Flash ROM BIOS for easy field upgrades
- ❖ PCI 2.1 Compliant
- ❖ Includes Mac® OS and PC Utility software
- ❖ SCSI Interface SCSI-1, SCSI-2, SCSI-3, UltraSCSI
- ❖ Extensive device support: up to 105 through LUNs (Wide and Narrow devices)
- ❖ Advanced SCSI
- ❖ Large Command FIFO
- ❖ Supports disconnect/reconnect

- ❖ Asynchronous I/O support
- ❖ Multiple Initiator support
- ❖ SCSI-3 Tagged Command Queuing
- ❖ Mac SCSI Manager 4.3 and pre 4.3 compatible driver

Operating Environments

- ❖ Windows 95/98, Windows NT/2000/XP
- ❖ Mac® OS 9, Mac OS X
- ❖ Linux®
- ❖ Sun Solaris®

Power Requirements

- ❖ 0.75 typical / 1.25 max. Amps @ + 5.0 VDC,
0.05 Amps @ +12.0 VDC

Environmental and Physical Specifications

Operating Temperature 0-50°C

Humidity 10-90% Non-condensing

Length 4.92" (PSC)
6.2" (DC)

Height 4.2"

MTBF 150,000 hours

MTTR < 15 minutes

SCSI Connectors

ATTO ExpressPCI PSC HD68 (high density 68-pin)

ATTO ExpressPCI DC 68-pin VHDCI external connectors (2), HD 68 internal connectors (2)

Maximum Host PCI Transfer Rate: 133 MB/sec.

Maximum SCSI transfer rates: synchronous data rate 40 MB/sec. per channel; asynchronous data rate: 12 MB/sec. per channel

2 SCSI is a key technology for storage

SCSI is a serial communications technology designed to transfer large amounts of data between a variety of hardware systems over long distances. It is a key technology for applications that require shared, high bandwidth access to storage.

SCSI provides a logical point-to point serial channel for the transfer of data between a buffer at a source device and a buffer at a destination device. It moves buffer contents from one port to another, without regard to the format or meaning of the data so different upper level protocols are able to run over SCSI hardware.

The SCSI architecture is structured as a hierarchical set of protocol layers. Defined within these layers are rules for signal interfaces, serial encoding and decoding, error control, frame format and communications protocols.

Glossary

Some terms used in the SCSI industry are defined below. More information is available through the ATTO Technology website (www.attotech.com), and the SCSI Consortium (www.iol.unh.edu/consortium).

Term	Definition
ANSI	American National Standards Institute
auto negotiation	hardware senses and automatically responds depending on configuration
BER	Bit Error Rate: a measure of transmission accuracy; the ratio of bits received in error to bits sent
bit	Smallest unit of data a computer can process: a single binary digit with a value of either 0 or 1
byte	an ordered set of 8 bits
CRC	Cyclic Redundancy Check: an error-correcting code which calculates a numeric value for received and transmitted data. If no error has occurred during transmission, the CRC for both received and transmitted data should be the same.
host	a processor, usually a CPU and memory, which communicates with devices over an interface
initiator device	A component which originates a command
LED	Light-emitting diode: a type of diode that emits light when current passes through it. Visible LEDs are used as indicator lights on all sorts of electronic devices.
originator	an initiating device; a component which originates a command
receiver	the ultimate destination of data transmission; a terminal device

Term	Definition
SCSI	Small Computer Systems Interface: a processor-independent standard for system-level interface between a computer and intelligent devices including hard disks, floppy disks, CD-ROM, printers, scanners, etc.
topology	logical layout of the parts of a computer system or network and their interconnections
transceiver	a transmitter/receiver module
transfer rate	the rate at which bytes or bits are transferred, as in megabytes or gigabits per second.

3 Installing the ExpressPCI SCSI Host Adapter

You will need a basic understanding of SCSI before installing the ATTO ExpressPCI host adapter. Please refer to Chapter 2 for a list of SCSI-related web sites. For more detailed explanations of cabling, connectors and termination, see Chapter 3.1.

WARNING Remember to back up your system data before changing or installing hardware.

WARNING ATTO ExpressPCI host adapters contain components that are sensitive to electrostatic discharge (ESD). ESD can cause damage to the ExpressPCI host adapter. Please follow standard methods to avoid ESD.

System requirements

The ATTO Express PCI host adapter package contains the host adapter, the ATTO ExpressPCI Utilities CD and a warranty and registration card. If any of these items are missing, contact your ATTO authorized sales representative.

To successfully install and use your ATTO ExpressPCI SCSI adapter you need:

- ❖ A computer with an available PCI slot.
- ❖ SCSI devices
- ❖ Cable(s) and terminator(s).

Installation

- 1 Plan your SCSI device connections (see Chapter 3.1).
- 2 Shut down the system and all peripherals before installing the adapter. After turning off the computer, leave the power cable plugged into a grounded outlet to discharge static electricity.
- 3 Open the computer case.
- 4 Install the ATTO ExpressPCI host adapter in any open PCI expansion slot. If you have

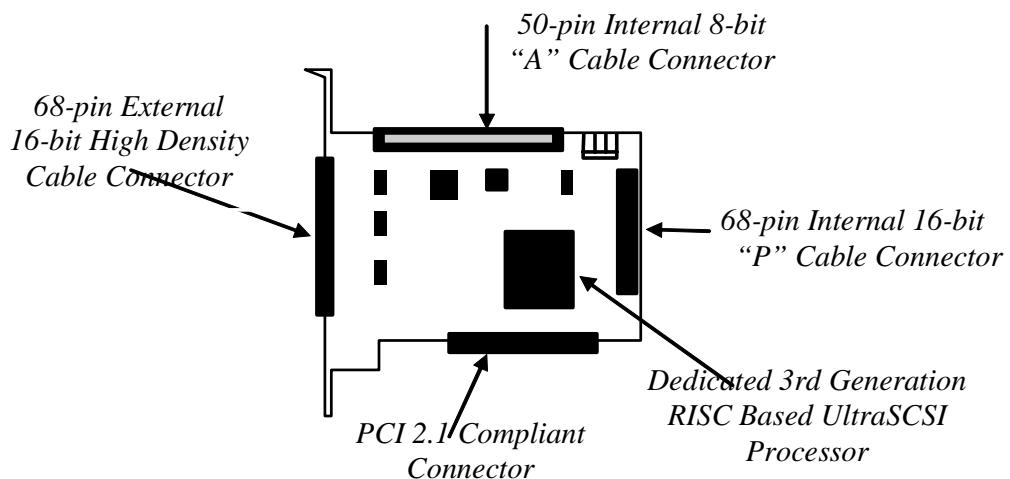
questions about how to install an expansion card in your system, consult your computer's documentation.

- 5 Replace the computer cover.
- 6 Connect SCSI devices by inserting a SCSI cable to the connector on the ATTO ExpressPCI host adapter. Refer to Exhibit 3.1-2 when selecting cables.
- 7 Power up your computer.
- 8 Set SCSI device termination. (see Chapter 3.1)
- 9 Set SCSI IDs. Adapter default is 7.

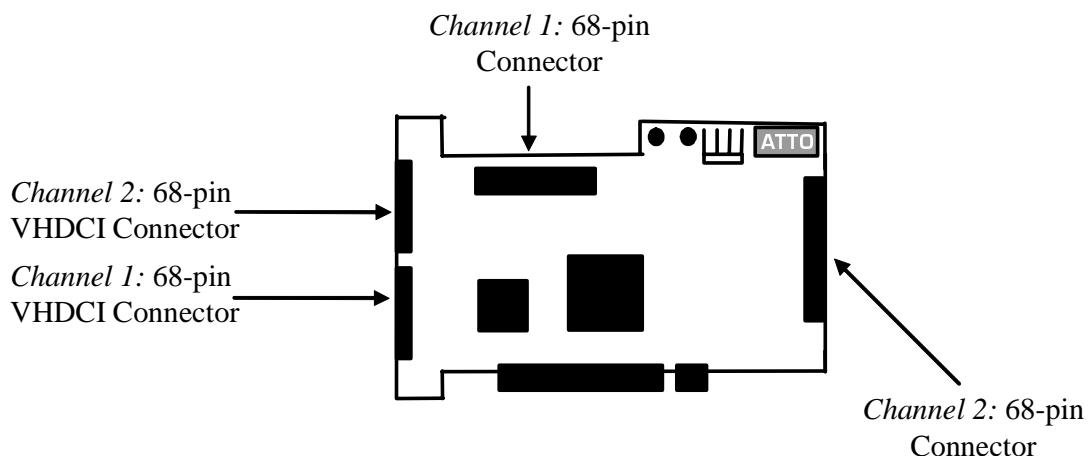
Each device on the SCSI bus requires a unique SCSI ID. If installing a single device, make sure you do not assign it the same SCSI ID as your ATTO ExpressPCI SCSI adapter. Do not change the adapter ID if possible. For more information and ease in changing the ID, consult the ExpressPCI Utilities Installation and Operation Manual.

- 10 ATTO ExpressPCI host adapters come preconfigured to operate properly in a variety of common system setups. However, some systems or setups may benefit by tuning the adapter for optimal performance. Use the ATTO ExpressPCI Utilities to change host adapter settings. Refer to Chapter 3.2 for more information.
- 11 If necessary, install drivers for your operating system from the ATTO ExpressPCI Utilities CD. Refer to Chapter 3.2 for more information.

The ATTO ExpressPCI PSC SCSI adapter



The ATTO ExpressPCI DC SCSI adapter



3.1 Determining cabling and termination

Cables and devices must be chosen to maximize performance and minimize the electrical noise from the high-speed data transfers available with the SCSI protocol. Cabling and termination methods become important considerations for proper performance. SCSI cables and devices are subject to specific length and number limitations to deal with electrical problems that arise at increased operating speeds.

Cable types

Single-ended and differential SCSI host adapters use the same cables. Use high-quality cables rated for the type of SCSI transfers required: well-insulated SCSI cables ensure error free communications. Try to keep cable lengths as short as possible to ensure higher signal quality and performance.

Examples

The SCSI specification limits total bus cable length for Single-Ended SCSI in a non-UltraSCSI

environment to 3 meters (combined length of both internal and external cable lengths).

In an UltraSCSI workgroup environment with a 7-drive tower, you are limited to 1.5 meters between the host and the tower, including the cabling for the tower. If the 7-drive tower requires 1 meter of cabling to connect all of its drives, the distance from the tower to the host must be .5 meters.

NOTE UltraSCSI is very sensitive to SCSI bus noise, cable distances and the number of devices connected on the SCSI bus. Carefully connect your devices when working with UltraSCSI.

Exhibit 3.1-1 Various types of SCSI require different bus lengths to support a certain number of devices.

STA terms	Bus speed MB/sec. max.	Bus width bits	Max. bus lengths, meters			Max. device support
			Single-ended	Differential	LVD	
Fast SCSI	10	8	3	25	12	8
Fast/WIDE SCSI	20	16	3	25	12	16
UltraSCSI	20	8	1.5	25	12	8
UltraSCSI	20	8	3	n/a	n/a	4
Ultra/WIDE SCSI	40	16	n/a	25	12	16
Ultra/WIDE SCSI	40	16	1.5	n/a	n/a	8
Ultra/WIDE SCSI	40	16	3	n/a	n/a	4
Ultra2 SCSI	80	16	n/a	n/a	12	8
Ultra2/WIDE SCSI	80	16	n/a	n/a	12	16

Connectors

ATTO ExpressPCI PSC: one industry standard 68-pin “P” (16-bit) and one 50-pin (8-bit) cable connector for internal device connections and one 68-pin “P” (16-bit) cable connector for external device connections.

ATTO ExpressPCI DC: two industry standard 68-pin “P” (16-bit) cable connectors for internal

device connections and two 68-pin “P” (16-bit) VHDCI (Very High Density Cabled Interconnect) cable connectors for external device connections.

NOTE When installing SCSI devices on the ATTO ExpressPCI PSC, use any two SCSI ports on your ATTO ExpressPCI SCSI adapter, but not all three. Use all four channels on the ATTO ExpressPCI DC.

Connection considerations

If using a combination of Wide 16-bit devices and Narrow 8-bit devices on the same connector, Wide devices must be connected first (closest to

Exhibit 3.1-2 Several types of internal and external cable connectors.

Termination

The SCSI bus is a chain of SCSI devices. The devices at both ends of any SCSI chain must be terminated for the SCSI bus to function correctly. A SCSI device chain can be configured in three different ways: internal, external and an internal/external SCSI device chain.

The ATTO ExpressPCI SCSI adapter is a SCSI device and may require termination depending upon the configuration. Be sure to use the correct terminator. Single-Ended, Low Voltage Differential and Differential SCSI buses use different types of terminators that should not be mixed.

Single-Ended ATTO ExpressPCI PSC/DC

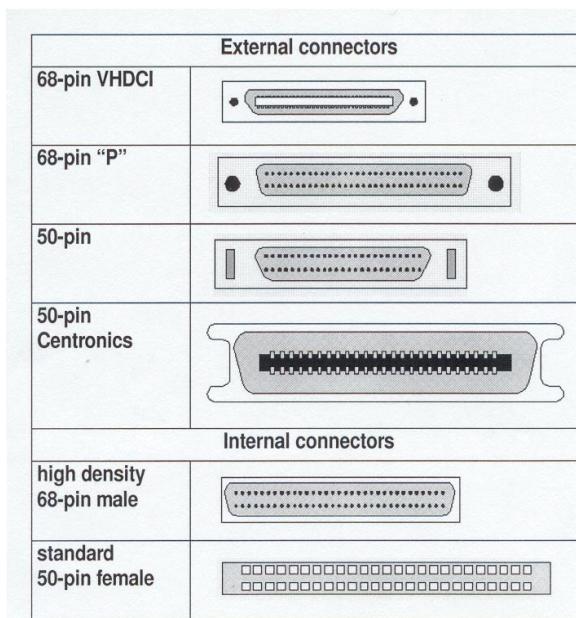
incorporates advanced termination circuitry to automatically configure its own termination.

Exhibit 3.1-3 Two LEDs on the top edge of the ATTO ExpressPCI PSC/DC provide feedback on its automatic termination setting.

LED1 (Low Term)	LED 2 (High Term)	ATTO ExpressPCI-PSC termination
On	On	All 16 data bits terminated
Off	Off	No termination
Off	On	Upper 8 bits terminated

You should not have to manually adjust the termination of your adapter unless you a narrow (8 bit) device attached to the external port *AND* a

the connector), followed by the Narrow devices. Please refer to the documentation you received with your SCSI devices to determine if your device is Wide or Narrow.



wide (16 bit) device attached to the internal port of your ATTO ExpressPCI PSC/DC *OR* if you attached a narrow (8 bit) device to the internal WIDE (16 bit) connector and a WIDE (16 bit) device to the external port. You must manually terminate the adapter using ATTO ExpressPCI Utilities program with the termination option set to Upper.

The ATTO ExpressPCI SCSI adapter only controls its own termination. You must terminate the last device of both the internal SCSI chain and the external SCSI chain.

To set up cabling and termination:

- 1 **Determine whether your ATTO Express PCI adapter is a single channel or dual channel model. One external connector indicates a single channel host adapter; two external connectors indicate a dual channel host adapter.**
- 2 **Determine if SCSI devices will be installed internally or externally.**

Total bus cable length, varies by host adapter and type of attached devices. Refer to Exhibit 3.1-1 for details on maximum cable length.

If you combine Wide 16-bit and Narrow 8-bit devices on the same connector, connect the Wide devices first (closest to the connector).

Exhibit 3.1-4 Please refer to the documentation for your SCSI devices to determine they are Wide or Narrow.

Internal Connection	External Connection	Termination Selection
Wide Device	Wide Device	None
not used	Wide Device	Full
Wide Device	not used	Full
Narrow Device	not used	Full
not used	Narrow Device	Full
Narrow Device	Wide Device	Upper
Wide Device	Narrow Device	Upper
Narrow Device	Narrow Device	Upper

3 Determine which terminator to use

Use an LVD terminator if you are only using LVD devices. Although you can use a Single-Ended terminator, all devices will be limited to Ultra SCSI speeds. Single-Ended devices require a Single-Ended terminator. If you use an LVD terminator with Single-Ended devices, the system may hang or devices may not be seen on the SCSI bus. Some termination manufacturers provide automatically sensing terminators.

External terminators should be attached to the last external device in the SCSI chain. Don't use any other termination on the external SCSI chain. The last device on an internal SCSI chain should also be terminated. This can be done in several ways. Many Single-Ended Ultra SCSI and earlier

devices provide a jumper setting for applying termination: place a jumper over the pins designated for termination on the last device on the internal cable. Check with your drive manufacturer if you are not sure which pins to use.

Wide (16-bit) and Narrow (8-bit) devices can be connected together on the same connector of the host adapter card, but wide devices must be attached first, followed by narrow devices.

To terminate the SCSI bus, the cable or adapter used to convert from a wide (68-pin) connector to a narrow (50-pin) connector provides partial termination, allowing upper 8-bits (or byte) of the wide SCSI bus to be properly terminated. A narrow terminator should be used on the last narrow device to terminate the rest of the SCSI bus. A SCSI bus without partial termination between the wide and narrow devices may at first appear to work correctly, but occasional I/O errors will occur without proper termination.

NOTE If you use both internal and external connectors and mix Single-Ended and LVD devices on the same bus, even if using different connectors, the host adapter card will operate with Single-Ended signaling at UltraSCSI speeds.

Automatic termination: when both internal and external connectors are used, the host adapter card detects the presence of devices and turns off termination. If devices are removed from one connector of the card, the host adapter will automatically detect the change and enable its own termination.

Software controlled termination: You may have to override the host adapter's automatic termination if only narrow devices are attached to one connector and wide devices are attached to the other connector on the same bus. The host adapter must supply partial termination to the upper 8-bits (byte), but it will not do so automatically. Please refer to your ExpressPCI Utilities manual to set the host adapter's termination to Upper Byte.

Termination power: host adapters supply termination power to the bus at all times and many SCSI devices are also able to supply termination power. SCSI signal quality, particularly with long or marginal quality cables, may be improved if the

device supplies the termination power. Contact your device manufacturer for more information on your device's ability to supply termination power.

3.2 Installing and Updating Device Drivers

After installing the ATTO ExpressPCI host adapter, you must configure your system to recognize and use it by installing drivers for your operating system. If you already have one or more ExpressPCI adapters installed and you are installing additional adapter(s), you do NOT need to perform any of these procedures unless you are updating a previously installed driver.

Windows Server 2003 & Windows 2000/XP

To install or upgrade the ExpressPCI driver

- 1 Log on to Windows as the system administrator.
- 2 Insert your ExpressPCI Installation Disk
- 3 Run *Setup.exe*
- 4 Click *Install*
- 5 Follow the instructions to complete the installation.

To add drivers to an existing Windows installation if you are NOT replacing the adapter to which the boot disk drive is attached.

NOTE Complete this installation procedure before attaching any devices to the adapter. If another driver has been loaded before the ExpressPCI driver is loaded and you are using ATTO striping, you may experience data corruption.

- 1 Log on to Windows as the system administrator.
- 2 Insert your ExpressPCI Installation Disk
- 3 Run *Setup.exe*
- 4 Click *Install*
- 5 Follow the instructions to complete the installation.
- 6 Shut down Windows when the Setup window prompts you to do so.
- 7 Install your ExpressPCI adapter into an available PCI expansion slot.
- 8 Restart Windows. Windows should detect your ExpressPCI adapter.
- 9 **Windows Server 2003/XP:** Insert the ExpressPCI Installation disk when prompted
Windows 2000: The *Found New Hardware Wizard* will appear: proceed through the wizard defaults and insert the ExpressPCI Installation disk when prompted.
- 10 When adapter installation is complete, the *Found New Hardware Wizard* will appear showing an *ATTO Phantom Device* for each

channel. Proceed through the wizard with the default settings to complete the installation.

To add support to an existing Windows installation if you ARE replacing the adapter to which the boot disk drive is attached

- 1 Log on to Windows as the system administrator.
- 2 Insert your ExpressPCI Installation Disk
- 3 Run *Setup.exe*
- 4 Click *Install*
- 5 Follow the instructions to complete the installation
- 6 Leaving the existing adapter in the system with the devices attached, shut down Windows
- 7 Attach the desired devices from your previous adapter to the ExpressPCI adapter and, if desired, remove the previous adapter.
- 8 Restart Windows.

To install a new copy of Windows onto a SCSI disk attached to the ExpressPCI adapter.

- 1 Start Windows text mode setup as per the instructions provided with Windows.
- 2 When the first blue window, *Windows Setup*, appears, press *F6*. The setup program will display a prompt in the status window on the bottom left of the monitor. Setup will continue to load files
- 3 At the new window with instructions to specify additional mass storage devices, press *S*.
- 4 Insert the ExpressPCI installation disk in drive A: and press *Enter*.
- 5 At the screen from which you would normally select a driver, a list of ExpressPCI adapters should appear. Select your adapter and press *Enter*.
- 6 Windows Setup will load the files from the disk.
- 7 ATTO ExpressPCI device should now be listed as detected in the screen which appears.
- 8 Repeat steps 3-7 for any other vendor-supplied driver installation disks.

- 9 After all other drivers have been processed, press *Enter* and proceed with the rest of the Windows Installation procedure.

NOTE When Windows begins copying files to your hard disk, you will again be prompted to insert the ExpressPCI

installation disk and any other vendor-supplied disks you used during custom installation. This is normal. The first time you inserted the disks, Windows loaded the drivers into memory; the second time, Windows copied the driver to the hard disk.

Windows NT Installation

To install/upgrade the Windows NT driver

- 1 Log on to Windows as the system administrator.
- 2 Open the *SCSI Adapters* applet in the *Control Panel*
- 3 Click on *Drivers* tab.
- 4 Click *Add...*
- 5 Click *Have Disk...*
- 6 Insert your ExpressPCI Installation Disk
- 7 Enter the path for it under *Copy manufacturer's files from*
- 8 Click *OK*
- 9 A list of ExpressPCI adapters will be displayed. Select your adapter and click *OK*.
- 10 Windows will install the necessary files and prompt you to restart Windows.
- 11 Restart Windows to complete the ExpressPCI installation.

To add a driver to an existing Windows installation when you are NOT replacing the adapter to which the boot disk drive is attached.

- 1 Install the ExpressPCI adapter into an available PCI expansion slot.
- 2 Log on to Windows as the system administrator.
- 3 Open the *SCSI Adapters* applet in the *Control Panel*
- 4 Click on *Drivers* tab.
- 5 Click *Add...*
- 6 Click *Have Disk...*
- 7 Insert your ExpressPCI Installation Disk
- 8 Enter the path for it under *Copy manufacturer's files from*
- 9 Click *OK*
- 10 A list of ExpressPCI adapters will be displayed. Select your adapter and click *OK*
- 11 Windows will install the necessary files and prompt you to restart Windows.

- 12 Restart Windows to complete the ExpressPCI installation.

To add a driver for your ExpressPCI adapter to an existing Windows installation if you ARE replacing the adapter to which the boot disk drive is attached

- 1 Insert the adapter into an available PCI expansion slot, but DO NOT remove the existing adapter or disconnect devices from it.
- 2 Log on to Windows as the system administrator.
- 3 Open the *SCSI Adapters* applet in the *Control Panel*
- 4 Click on *Drivers* tab.
- 5 Click *Add...*
- 6 Click *Have Disk...*
- 7 Insert your ExpressPCI Installation Disk
- 8 Enter the path for it under *Copy manufacturer's files from*
- 9 Click *OK*
- 10 A list of ExpressPCI adapters will be displayed. Select your adapter and click *OK*
- 11 Windows will install the necessary files and prompt you to restart Windows.
- 12 Restart Windows to complete the ExpressPCI installation.
- 13 Shut down Windows, attach the desired devices from your previous adapter to the ExpressPCI adapter and, if desired, remove the previous adapter.
- 14 Restart Windows.
- 15 If you removed the previous adapter, you will see messages stating that one or more services did not start, suggesting that you look in the system log. To avoid receiving these messages on subsequent system startup attempts, use the *SCSI Adapters* applet in the *Control Panel* to remove the driver for the previous adapter.

To install a new copy of Windows NT onto a SCSI disk attached to your ExpressPCI adapter.

- 1 Start Windows NT text mode setup as per the instructions provided with Windows NT.
- 2 Press *F6* when the first blue window, *Windows NT Setup*, appears. Setup will continue to load files.
- 3 After loading the setup files, you will be given several choices. Press *Enter* to install Windows.
- 4 From the list of devices detected by Windows, press *S*.
- 5 Choose *Other* to install the ExpressPCI driver and any other drivers for which you have OEM-supplied installation disks.
- 6 Insert the ExpressPCI installation diskette in drive A:

7 Press *Enter*

- 8 Windows should load the driver, detect the presence of the ExpressPCI adapter, then return to the screen of step 3. The ExpressPCI driver should now be included in the list of devices. Repeat steps 3 - 8 for any other vendor-supplied driver installation disks.
- 9 After all other drivers have been processed, press *Enter* and proceed with the rest of the Windows Installation procedure.

NOTE When Windows begins copying files to your hard disk, you will be prompted to insert the ExpressPCI installation disk and any other vendor-supplied disks you used during custom installation. This is normal. The first time you inserted the disks, Windows loaded the drivers into memory; the second time, Windows copied the driver to the hard disk.

Re-flashing Firmware in Windows

ATTO typically releases adapter firmware and drivers simultaneously. We recommend that both the firmware and drivers be updated to ensure proper operation.

To re-flash the firmware to the latest version:

- 1 Obtain the latest firmware from the ATTO web site www.attotech.com.
- 2 Extract the firmware to a floppy disk by executing the self-extracting file.
- 3 Reboot the PC.
- 4 An ATTO Technology banner will announce that the host adapter was detected. Enter *Control-Z* when prompted to begin the setup utility.
- 5 Select the *Upgrade Flash ROM* option and insert the disk into the drive slot.

6 Follow the on-line instructions.

7 Remove the disk and reboot the PC.

NOTE Firmware must be loaded from a floppy or from the internal hard drive because the CD-ROM drivers are not loaded at this point in the system boot process.

To re-flash the firmware to the latest version for Ultra320 adapters:

The ATTO ExpressPCI Configuration Tool, available on the ATTO web site, www.attotech.com/software/index.html, will verify drivers and firmware versions and attempt to flash. Instructions for using this utility are provided as part of the download process.

Linux and Sun Solaris Driver Installation

ATTO offers Linux and Sun Solaris drivers which are compatible with the ExpressPCI host adapters. A complete download package, including all necessary installation instructions, is available on

the ExpressPCI Utilities CD-ROM or directly from the ATTO Technology web site, www.attotech.com. Please refer to these documents for installation instructions.

Updating Drivers and Re-flashing Firmware in Mac OS X

Mac OS X drivers, including installer packages, can be downloaded directly from the ATTO web site, www.attotech.com. The driver installers will automatically unionist existing drivers and properly install the new drivers on your system. After installing, the new adapter driver you will need to update the firmware.

The ATTO ExpressPCI Configuration Tool, available on the ATTO web site, www.attotech.com/software/index.html, will verify drivers and firmware versions and attempt to flash. Instructions for using this utility are provided as part of the download process.

Updating Drivers and Re-flashing Firmware in Mac OS 9

To re-flash the firmware to the latest version:

- 1 Obtain the latest firmware and updater program from the ATTO web site www.attotech.com and download to your host.
- 2 Create a folder or drive where you want the program files to be placed.
- 3 Using a compression utility capable of handling *hqx* files, extract the files by clicking *Save*.

- 4 Open the program file folder and click on the *ExpressPCI Updater* program.
- 5 Select the appropriate option and hit *Enter*.
- 6 A message will inform you which ExpressPCI cards were updated.
- 7 Type *Q* to quit.
- 8 Re-boot the Macintosh system.

4 Maximizing Performance with your ExpressPCI HBA

If you are getting less performance than you expect, there are several things you can do such as making sure you are using the latest ATTO driver, setting the registry entry for large block transfers, using ATTO ExpressRAID for setting up RAID groups, increasing transfer size, and analyzing your system's I/Os.

While the factory settings on your ExpressPCI host adapter should provide excellent performance for a wide range of applications, you may improve performance by modifying some of the system factors which affect your ExpressPCI host adapter.

For example, the ATTO driver can transfer well over a megabyte with one SCSI command.

NOTE You must use an ATTO driver when using ATTO ExpressRAID software.

Use the latest ATTO driver

Determine which drive is currently in use, then install the latest ATTO driver found at www.attotech.com.

Windows NT

- 1 Open My Computer
- 2 Open Control Panel
- 3 Open SCSI Adapters
- 4 Examine the Driver tab for your SCSI adapter. If the driver is not express.sys, install the express.sys driver.
- 5 Either remove the previously-installed driver or disable it using the Devices applet. If the system has a built in Symbios or LSI adapter, do not disable the driver for that adapter.

Windows 2000 and XP

- 1 Using the Device Manager, select SCSI & RAID Controllers
- 2 Examine the Driver tab for your SCSI adapter. If the driver is not express.sys, install the express.sys driver.
- 3 Either remove the previously-installed driver or disable it using the Devices applet. If the system has a built in Symbios or LSI adapter, do not disable the driver for that adapter.

Set registry for large block transfers

If your application requires large block transfers, set the registry entry correctly for the MaximumSGList keyword. Several files supplied with the device driver download package can set this value to any one of the following sizes: 64Kb, 128KB, 256Kb, 512KB, 1MB and NT default (64KB). The files are ASCII text files and can be viewed with any suitable editor. The files also explain the registry setting and how to change the setting.

The ExpressPCI adapter can have a maximum transfer size from 64KB to 1MB. If the registry value is set to a number higher than 0xff, the driver will reduce the setting to 0xff. The driver installation process will set the default value to 0xff.

Set up RAID groups with ATTO ExpressRAID

Instead of using the RAID functionality built into Windows OS, use the ATTO ExpressRAID software for the most efficient performance.

ATTO ExpressRAID requires one less level of driver through which commands must pass and fewer commands are required to pass through the driver hierarchy.

Other advantages of ATTO ExpressRAID striping:

- ❖ You can boot your system off striped drives
- ❖ Stripe sets created with ExpressRAID are recognizable by DOS and Windows
- ❖ You can stripe removable-media drives with ExpressRAID.

If you have purchased the striping option, additional information about ExpressRAID is

available in the file *Stripe.txt* on the CD which has been included with your ATTO ExpressPCI adapters.

Increase transfer size

If you are writing to an application that uses a lot of sequential disk I/O to a contiguous area on disk, you should use as large a transfer size as possible to reduce overhead on the system, on the SCSI bus and within disk drives.

Analyze your I/Os

For large sequential data transfers, use Direct I/O by selecting *FILE_FLAG_WRITE_THROUGH* and *FILE_FLAG_NO_BUFFERING* flags with your *CreateFile* call to avoid the overhead of copying data from one area of memory to another, to reduce the number of SCSI commands which must be executed and to leave system pages available for other data.

If your application requires a small number of I/Os and the transfers are rather small, however, you may get better performance by letting the system cache your data in the system pages.

You might want to use over-lapped I/O using the *FILE_FLAG_OVERLAPPED* option with the *CreateFile* call. Overlapped I/O allows the

application to send many commands to the device at once.

The ATTO Disk Benchmark program, included with the ExpressPCI Utilities on the CD shipped with your ExpressPCI adapter, shows the effect of using the above I/O modes.

- ❖ If you turn off Direct I/O and set the file size to a value significantly less than the amount of memory in your computer, you will get some artificially high transfer rates because very little I/O is actually being performed by the SCSI device: all the activity is involved in transferring data between the application and the system pages.
- ❖ As you increase the file size to a value more than the amount of memory in your computer, you will see marked performance degradation.
- ❖ If you turn on Direct I/O, you can see the effect of removing the system pages from the overhead picture.
- ❖ If you use overlapped I/O, you will see performance improvements in the low to medium transfer sizes.
- ❖ However, depending on the amount of memory in your computer, you may not be able to use queue depths greater than 4 or 5.

5 Troubleshooting

This chapter contains solutions for the most common problems you might encounter. If you need additional assistance, please refer to the ATTO Technology web site (www.attotech.com) or contact an ATTO Technology authorized representative.

- ✓ Check each cable connection on every device. Verify all cables are in proper working condition. Loose or broken cables are often the cause of errors or problems.
- ✓ Check that your SCSI devices are plugged into an AC outlet and are turned on before you add power to your computer.
- ✓ Verify that all devices and busses are properly terminated. See Chapter 3.1 for more information.
- ✓ Verify that all devices attached to the ATTO ExpressPCI SCSI adapter have unique SCSI IDs. ATTO ExpressPCI SCSI adapters have a default SCSI ID of 7.
- ✓ If the same device shows up at several different SCSI IDs, either its SCSI ID is set the same as the ATTO ExpressPCI SCSI ID, or the cable is defective.
- ✓ If a device doesn't appear and cables and termination are set properly, try lengthening the SCSI Reset Delay using the ExpressPCI Utilities found on the CD that came with your host adapter.
- ✓ PC users should make sure that SCSI adapter firmware and Windows drivers are at the same revision level. Unless indicated otherwise, the latest drivers and firmware can be downloaded from the ATTO Technology website (www.attotech.com)

Appendix A Standards and compliances

The equipment described in this manual generates and uses radio frequency energy. The Technical Specification sheet for a particular ATTO ExpressPCI host bus adapter list certifications for that model.



FCC standards: radio and television interference

WARNING This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ❖ Reorient or relocate the receiving antenna
- ❖ Increase the separation between the equipment and receiver
- ❖ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- ❖ Consult the dealer or an experienced radio/TV technician for help



Canadian standards

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.



European standards

Declaration of Conformity

This following statement applies to the ATTO Express PCI host bus adapter.

This device has been tested in the basic operating configuration and found to be compliant with the following European Union standards:

Application of Council Directive: 89/336/EEC

Standard(s) to which conformity is declared: [EN55024:1998](#)

This Declaration will only be valid when this product is used in conjunction with other CE approved devices and when the entire system is tested to the applicable CE standards and found to be compliant.

Usage restrictions

The use of optical instruments with this product will increase eye hazard.

The multimode transceiver (ATTO Express PCI FC 3300 only) is a Class 1 laser product complying with IEC 825-1 and FDA-21 CFR 1040.11. To meet laser safety requirements, the transceiver shall be operated within the maximum ratings. The laser is non-OFC compliant as it is a Class 1 device.

The optical ports of the modules must be terminated with an optical connector or with a dust plug.

CAUTION Failure to adhere to the above restrictions could result in a modification that is considered an act of "manufacturing" and will require, under law, recertification of the modified product with the U.S. Food and Drug Administration (ref. 21 CFR 1040.10(i)).

Appendix B SCSI host adapter selection guide

ATTO Technology offers a number of SCSI and Fibre Channel solutions for storage. The following chart compares the features of ExpressPCI SCSI host adapters.

Supported platforms: Sun Solaris; Linux; NetWare; SCO Unix; Windows 2000, 95/98, NT, and Macintosh OS and OS X.

Complete RAID packages are also available and include an ExpressPCI SCSI host adapter, ExpressRAID software and appropriate cable(s). Add "-KIT" suffix to host adapter product code (i.e. EPCI-UL3D-KIT)

Specific features

<i>Single Channel</i>	ExpressPCI Ultra 320	Express PCI Ultra 3	Express PCI Ultra Wide
Max. transfer rate	320 MB/sec	160 MB/sec.	40 MB/sec.
LVD	✓	✓	
HVD			
64-bit	✓	✓	
32-bit	✓	✓	✓
33/66 MHZ	✓	✓	
133 MHZ	✓		
Bus ID support	30	30	15
Part number	EPCI-UL4S	EPCI-UL3S	EPCI-PSC

<i>Dual Channel--- 2 independent channels</i>	ExpressPCI Ultra 320	Express PCI Ultra 3
Max. transfer rate	640 MB/sec	320 MB/sec.
LVD	✓	✓
64-bit	✓	✓
32-bit	✓	✓
33/66 MHZ	✓	✓
133 MHZ	✓	
Bus ID support	30	30
Part number	EPCI-UL4S	EPCI-UL3D

Appendix C Fibre Channel host adapter guide

ATTO Technology offers a number of SCSI and Fibre Channel solutions for storage. The following chart compares the features of ExpressPCI Fibre Channel host adapters.

Supported platforms: Sun Solaris; Linux; NetWare; SCO Unix; Windows 2000, 95/98, NT, and Macintosh OS and OS X.

Complete RAID packages are also available and include an ExpressPCI SCSI host adapter, ExpressRAID software and appropriate cable(s). Add "-KIT" suffix to host adapter product code (i.e. EPCI-UL3D-KIT)

	ExpressPCI FCSW	Express PCI FC 2600	ExpressPCI FC 3300	ExpressPCI FC 3321	Express PCI FC 3305
Fibre Channel ports	1	1	1	2	1
Optical interface	Fixed SW SC		Fixed SW LC	Fixed SW LC	
Copper interface		HSSDC			HSSDC
Max. transfer rate	200 MB/sec. full duplex	200 MB/sec. full duplex	400 MB/sec. full duplex	400 MB/sec. per channel full duplex	400 MB/sec. full duplex
Class 2 transfers	✓	✓	✓	✓	✓
Class 3 transfers	✓	✓	✓	✓	✓
Full duplex	✓	✓	✓	✓	✓
66 MHz backward compatible with 33 MHz	✓	✓	✓	✓	✓
64- and 32-bit PCI support	✓	✓	✓	✓	✓
Windows® XP/2000/NT; Windows 95/98; Linux and Macintosh® OS, OS X	✓	✓	✓	✓	✓
RAID support	✓	✓	✓	✓	✓
Max. cable length	500 m	25 m (175 m with MIA)	500 m	500 m	25 m (175 m with MIA)
Part number	EPCI-FCSW-000	EPCI-2600-000	EPCI-3300-000	EPCI-3321-000	EPCI-3305-000

Complete RAID packages are also available. To receive the ATTO ExpressPCI host adapter, ExpressRAID software and appropriate cable(s), add "-KIT" to host adapter product code (i.e., EPCI-2600-000-KIT) when ordering.

Appendix D Contact ATTO Technology, Inc.

Customer service, sales information and technical support are available by phone Monday through Friday, Eastern Standard Time 8:00 a.m. to 8:00 p.m., or by e-mail and web site 24-hours a day.

ATTO Technology, Inc.

155 CrossPoint Parkway
Amherst, New York 14068
(716) 691-1999 • voice
(716) 691-9353 • fax
<http://www.attotech.com>

ATTO Technology can also be reached via e-mail at the following addresses:

Sales Support: sls@attotech.com

Technical Support: techsupp@attotech.com